

1c377 U.S. PTO
09/01/98

PATENT
Attorney Docket No.: 8733D-6658

A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Hee Young Yun, et al.)
Serial No:)
Filed: September 1, 1998)
For: COMPUTER HAVING LIQUID CRYSTAL)
DISPLAY BETWEEN FRAMES)
ATTACHED AT THE EDGES)
_____)

Art Unit:
Examiner:

1c530 U.S. PTO
09/14/98
09/145357

CERTIFICATE OF MAILING VIA U.S. EXPRESS MAIL
"Express Mail" Mailing Label No. EM412468131US
Date of Deposit: September 1, 1998

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

- I hereby certify that
- ☒ two copies of a letter of transmittal
 - ☒ check in amount of \$ 790 as filing fee
 - ☒ patent application (14 pages of specification; 1 claim(s); 1 pages of abstract
 - ☒ 7 sheet(s) of formal drawings
 - ☐ executed Declaration and Power of Attorney
 - ☐ executed Assignment, with Recordation Cover Letter and check in amount of \$40
 - ☐ certified copy of patent application No. which was filed from which priority is claimed in the subject case pursuant to 35 USC § 119
 - ☒ Preliminary Amendment
 - ☒ Information Disclosure Statement with _____ references
 - ☒ return postcard

are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service with sufficient postage under 37 CFR 1.10 on the date indicated above and are addressed to:

Assistant Commissioner for Patents
Washington, D.C. 20231.

September 1, 1998
Date of Deposit

CHRIS TOMAYO
Name of person mailing papers


Signature

Docket No. 8733D-6658
Express Mail Label No. EM412468131US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Anticipated Classification
of This Application:
Class ____ Subclass ____

Prior Application:
Examiner T. Ton
Art Unit 2871

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

This is a request for filing a:

☒ continuation application

☐ divisional application

pursuant to 37 CFR §1.53(b), of pending prior application:

Serial No. 08/888,164 filed July 3, 1997,
by Hee Young YUN, et al.

(inventor(s) currently of record in prior application)

for COMPUTER HAVING LIQUID CRYSTAL DISPLAY BETWEEN FRAMES
ATTACHED AT THE EDGES.

1. ☒ Enclosed is a copy of the prior application, including the oath or declaration as originally filed, or a replacement specification which does not add new matter.
2. ☒ The filing fee is calculated below:

CALCULATION OF FEES					
ITEM		NO. OF CLAIMS FILED MINUS BASE*	NO. OF CLAIMS OVER BASE	X SM/LG ENTITY FEE	\$ AMOUNT
A	TOTAL CLAIMS FEE	1 - 20* =	0	X \$11 or X \$22	\$0
B	INDEPENDENT CLAIMS FEE**	1 - 3* =	0	X \$41 or X 82	\$0
C	SUBTOTAL - ADDITIONAL CLAIMS FEE (ADD FINAL COLUMN IN LINES A + B)				\$0

D	MULTIPLE-DEPENDENT CLAIMS FEE	SMALL ENTITY FEE = \$135 LARGE ENTITY FEE = \$270	\$0
E	BASIC FEE*	SMALL ENTITY FEE = \$395 LARGE ENTITY FEE = \$790	\$790
F	TOTAL FILING FEE (ADD TOTALS FOR LINES C, D, AND E)		\$790
	**LIST INDEPENDENT CLAIMS		

3. ☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Account No. 12-1820. A copy of this sheet is enclosed.
4. ☒ A check in the amount of \$ 790 is enclosed.
5. ☒ Cancel in this application original claim(s) 2-14 of the prior application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)
6. ☒ Amend the specification by inserting before the first line the sentence:
 --This is a ☒ continuation ☐ division of application Serial No. 08/888,164 filed July 3, 1997, which application is hereby incorporated by reference in its entirety.--
- 7a. ☒ New formal drawings are enclosed.
- 7b. ☐ Priority of application Serial Nos.:
97-12899 filed April 8, 1997 and
97-14278 filed April 17, 1997, in
 in Korea is claimed under 35 USC §119.
 (country)
- 7c. ☒ The certified copy of the priority application is on file in prior application Serial No. 08/888,164, filed July 3, 1997.
8. ☐ The prior application is assigned of record to: LG Electronics Inc.
9. ☒ The power of attorney in the prior application is as listed on the attached copy of the declaration filed in the patent application.
- a. ☒ The power appears in the original papers in the prior application.
- b. ☐ Since the power does not appear in the original papers, a copy of the power in the prior application is enclosed.

c. ☒ Address all future communications to:

Song K. Jung
LOEB & LOEB LLP
10100 Santa Monica Blvd.
Los Angeles, CA 90067-4164
(310) 282-2000

10a. ☒ A preliminary amendment is enclosed. (Claims added by this amendment have been properly numbered consecutively beginning with the number next following the highest numbered original claim in the prior application.)

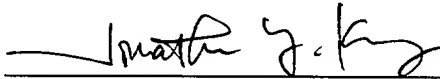
10b. ☐ A separate check for \$_____ is enclosed to cover additional claims added by the preliminary amendment.

11. ☐ Enclosed find the following declaration(s) in support of Small Entity status for this application:

- ☐ Inventor(s).
- ☐ Individual other than inventor.
- ☐ Nonprofit organization.
- ☐ Small business concern.

12. ☐ The statement(s) of Small Entity Status filed in the prior application is (are) still proper.

Dated: September 1, 1998


Jonathan Y. Kang
Reg. No. 38,199
☐ Attorney or agent of record.
☒ Filed under §1.34(a).

Address of signer:

LOEB & LOEB LLP
10100 Santa Monica Blvd., 22nd Floor
Los Angeles, California 90067-4164
Tel. No. (310) 282-2000
Fax No. (310) 282-2192

H:\JUNG\8733-D\6658\TRANCONT.APP

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Hee Young YUN, et al.)	Art Unit:
)	Examiner:
Serial No:)	
)	
Filed:)	
)	
For: COMPUTER HAVING LIQUID CRYSTAL)	
DISPLAY BETWEEN FRAMES)	
ATTACHED AT THE EDGES)	
_____)	

PRELIMINARY AMENDMENT

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to the examiner of the above-identified application on the merits, please amend the above-identified application as follows:

IN THE SPECIFICATION:

In the Background of the Invention, page 2, line 19, after the words "protecting sheet" insert --(diffuser)--.

REMARKS:

This application is a continuation application of application Serial No. 08/888,164 filed July 3, 1997. The parent application was allowed in a Notice of Allowance mailed April 28, 1998 (Batch No. Z99). The issue fee was paid on May 8, 1998.

Also enclosed with this application is a Form PTO-1449 listing the references cited during the prosecution of the parent application. Copies of cited references are

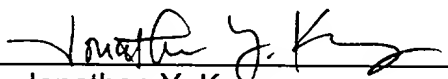
provided for the convenience of the Examiner.

An action on the merits of the application is respectfully requested.

Respectfully submitted,

LOEB & LOEB LLP
Attorneys for Applicant

Dated: September 1, 1998


Jonathan Y. Kang
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H:\JUNG\8733-D\6658\PRELIM.AMD

UNITED STATES PATENT APPLICATION

OF

HEE YOUNG YUN,

KYO HUN MOON,

AND

BYEONG YUN LEE

FOR

COMPUTER HAVING LIQUID CRYSTAL DISPLAY

This application claims the benefit of Korean Application No. 12899/1997 filed on April 8, 1997, and Korean Application No. 14278/1997 filed on April 17, 1997, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a computer, and more particularly, to a display unit of a portable computer.

Discussion of the Related Art

In general, a liquid crystal display(LCD) device used for a computer such as a portable computer or for a portable display is shown in Fig. 1. Referring to Fig. 1, the LCD device includes a liquid crystal panel 20, a back light unit, and a driving circuit board 23. The back light unit is comprised of a luminescent lamp 11, a lamp housing 12 having a U-shape and surrounding the lamp 11, a light guide 13, a reflector 14 reflecting the incident light from the horizontal direction to the vertical direction, a protection sheet 15 contacting the light guide 13, a first prism sheet 16 and a second prism sheet 17 set on the protecting sheet 15 and condensing the incident light from the light guide 13 to some

direction, a diffuser 18 diffusing the light from the first and second prisms 16 and 17 to a viewing area 21 of the liquid crystal panel 20 with a certain viewing angle, and a first support frame 19 supporting these elements.

5 Fig. ²~~1~~ shows a cross-sectional view of the light-guiding plate 13 showing a gradual thickness decrease in cross-section as it extends away from the light source 11. A fluorescent lamp 11 as the light source is fixed at a thicker end of the light-guiding plate 13. When the fluorescent lamp 11 is turned on, the light 23 from the source 11 is reflected by the lamp housing 12 surrounding the fluorescent lamp 11. The reflected light transmits through the cross-section towards the other side (thinner end) of the light-guiding plate 13 as indicated by the arrows. Then, the light spreads all over the surface of the light-guiding plate 13 and reaches the display area 21 (Fig. 1) through the diffusion plate 18. At the same time, a thin film transistor formed on the liquid crystal panel controls a corresponding pixel according to the signals from the driving circuit ²³~~20~~ (Fig. 1) to selectively transmit the light which collectively realizes the display of images on the display area.

The liquid crystal display is usually combined with, for example, a notebook computer as an output screen. The following

method is used to fix the liquid crystal display to a device such as a notebook computer.

Referring to Figs. 3a and 3b, in a conventional liquid crystal display, a ground supporting plate 30 is disposed on the first fastening ^{or support} frame 19. A mounting hole 33 is formed through the ground supporting plate 30 and the first fastening frame 19, as shown in Fig. 3b. Then, the ground supporting plate 30 and the first fastening frame 19 are fixed by a screw 31 as shown in Fig. 3a. In other words, a liquid crystal display is fixed to a device such as a notebook computer so as to fasten the first fastening frame 19 and the ground supporting plate 30 by a fastening element such as a screw.

However, the liquid crystal display becomes thicker due to the length of the screw according to the method as shown in Figs. 3a and 3b. Moreover, since the mounting hole 33 for the screw is formed on the front surface of the liquid crystal display, the display area of the liquid crystal display becomes narrow.

According to the structure described above, the LCD device operates as follows. The light from the luminescent lamp 11 is incident on the rear surface of the liquid crystal panel 20 through the back light unit. A control circuit placed on the driving circuit board ²³ ~~30~~ controls the incident light on the viewing area 21

of the liquid crystal panel 20 to display images and characters.

Fig. 4 is a drawing showing a plan view of the final assembly structure of the conventional liquid crystal display device. Fig. 4 also shows the assembled result of a second support frame 40, liquid crystal panel 20 and back light unit having an assembly structure for mounting to a portable computer. The second support frame 40 is made of metal or plastic, and holds the liquid crystal panel 20 and the back light unit. Here, the driving circuit board 23 is located behind the rear part of the back light unit connected to the liquid crystal panel 20 with a flexible film (not shown).

Fig. 5 shows the assembly structure of the liquid crystal panel 20 and body 60 of the portable computer in the conventional method. The second support frame 40 is mounted to a rear case 50 of the portable computer using screws 43 through screw holes 41. A front case(not shown) having a blank area adjusted to the viewing area is joined at the rear case 50. That is, the liquid crystal panel 20 is mounted with the rear case 50 by the screws 43 locked in the normal direction of the display surface through the screw holes 41 formed on that surface. Although not shown in the drawings, the front case is mounted on the LCD device, opening the viewing area 21 and covering the other parts.

In general, as the size of the portable computer is designed

for easy movement, the same goes for an A4 copy sheet, for example. Therefore, the ratio of the viewing area to the whole surface area of the display and the thickness of the display device affect the quality of the portable computer. However, in a conventional portable computer, screw holes 41 are located on edge portions of the display surface in order to join the second support frame 40 to the rear case 50. As the display area has a screw frame area 42 (Fig. 4) for forming the holes 41, the ratio of the area of the LC panel to the viewing area 21 is reduced.

Furthermore, in the conventional portable computer, as the screws 43 are locked to the liquid crystal display device and the rear case 50 in the normal direction of the display surface, the display part is thick enough to form an assembly device 51 for the screws 43, such as screw holes 41. The second support frame 40 is also large enough to have a space for supporting the screw holes 41. Thus, it is difficult to reduce the weight of the portable computer.

Accordingly, a liquid crystal device is needed having a high viewing ratio of the display, low weight, and reduced thickness for a computer, such as a portable computer.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a computer

that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to increase the ratio of the viewing area to the whole area of a computer display.

5 Another object of the present invention is to provide a thin, light weight display unit.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a liquid crystal display device comprises a liquid crystal panel including a display area; a light source joined with the liquid crystal panel; a first frame coupled to a surface of the light unit and sides of the liquid crystal panel; a second frame coupled to edges of the liquid crystal panel and sides of the first support frame; an outer casing; and a fastening part joining together the first support frame, the second support frame, and the

outer casing through the sides of the first support frame, the second support frame, and the outer casing.

5 In another aspect of the present invention, a portable computer comprises a liquid crystal display device having a display surface and a first plurality of side surfaces; a body having an input device; a cover, coupled to an edge of the body, having a second plurality of side surfaces; and a fastening unit attaching the first plurality of side surfaces of the liquid crystal display device to the second plurality of side surfaces of the cover, the liquid crystal display device being mounted to the cover.

10 In another aspect of the present invention, a portable computer comprises a liquid crystal display device having a first side surface; a body having an input device; a cover joined with the body and having a second side surface; and a fastening unit joining together the liquid crystal display device and the cover through the first and second side surfaces of the liquid crystal display device and the cover, respectively.

15 In a further aspect of the present invention a liquid crystal display device comprises a first support frame having a first fastening member at a side surface of the first support frame; a reflector unit adjacent the first support frame; a light source adjacent to the reflector unit; a light guide unit adjacent the

reflector unit; a protection unit adjacent the light guide unit; a prism unit adjacent the protection unit; a diffuser unit adjacent the prism unit; a liquid crystal panel adjacent the diffuser unit; and a second support frame having a second fastening member at a side surface of the second support frame, wherein the reflector unit, the protection unit, the prism unit, and the diffuser unit, the liquid crystal panel are between the first and second support frame, and the first and second support frame are attached to each other through the first and second fastening members through the side surfaces of the first and second support frames.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Fig. 1 is a perspective drawing showing the structure of the

conventional liquid crystal display device;

Fig. 2 is a cross-sectional view of a light-guiding plate and a fluorescent lamp;

Fig. 3a is a plan view of a liquid crystal display showing a screw frame of a first fastening frame;

Fig. 3b is a cross-sectional view of a liquid crystal display illustrating a first fastening frame, a lamp housing, and ground support plates fixed together by a screw;

Fig. 4 shows a plan view of the final assembly structure of the liquid crystal panel, support frame, and back light unit in the conventional liquid crystal display device;

Fig. 5 shows an assembly structure of the liquid crystal display device in the conventional portable computer;

Fig. 6 is a perspective view showing the assembly structure of the parts of the back light unit in accordance with the present invention;

Fig. 7 is a perspective view the assembly structure of the liquid crystal display device, the rear cover, and the front cover in accordance with the present invention;

Fig. 8 is a cross-sectional view of a liquid crystal display according to the present invention illustrating mounting holes at a side of the first fastening frame; and

Fig. 9 shows an assembly structure of the liquid crystal display device and portable computer in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

10 The present invention provides a mounting hole for a fastening element on a side of a liquid crystal display instead of on a front surface of a liquid crystal display. For example, Fig. 8 shows a first mounting hole 410a formed on a first fastening frame 190. With reference to Fig. 6, the structure of a liquid crystal display according to the present invention will be described in detail.

15 Referring to Fig. 6, on a first support frame 190 made of plastic, for example, a reflector 140, a light guide 130, a protection sheet 150, a first prism sheet 160, a second prism sheet 170, a diffuser 180, and a liquid crystal panel 300 are stacked sequentially. On the side surface of the first support frame 190, a plurality of first screw holes 410a are formed.

20 At the edge of the light guide 130, a luminescent lamp 110 and a lamp housing 120 are mounted. The lamp housing 120 has an U-shape and surrounds the luminescent lamp 110.

In order to join the first support frame 190, the liquid crystal panel 300, and the lamp housing 120, a second support frame 400 preferably made of metal is mounted at the side surface of the first support frame 190. At the side surface of the second support frame 400, a plurality of second screw holes 410b aligned with the first screw holes 410a are formed.

Referring to Fig 7, a liquid crystal display device 700 comprising the first support frame 190, the second support frame 400, and the liquid crystal panel 300 is joined with a rear case 500 and a front case 520. At the side surface of the rear case 500, third screw holes 410c aligned with second screw holes 410b are formed. The rear case 500 and the liquid crystal display device 700 are joined to each other by fastening devices such as screws 430, which are locked to the second and third screw holes 410b and 410c. Although not shown in the drawings, the screws 430 are also locked with the first screw holes 410a.

In another embodiment, in order to join the second support frame 400 and the rear case 500, an adhesive device such as double-sided adhesive tape can be used instead of the second and the third screw holes 410b and 410c. This example has an added advantage in that no screws are needed which makes the manufacturing method easy.

In a further embodiment, the rear case 500 and the second support frame 400 are jointed to each other using hooks and/or other suitable fastening devices including adhesives formed at inner sides of the rear case 500. This embodiment also does not need fastening devices such as screws 430.

Accordingly, in the present invention, the assembling or fastening devices are located at the side surface of the display and not at the front or back side. The assembling devices are preferably screws, hooks or, adhesive materials, for example. The direction of the assembling devices is normal to the side surface of the display, that is, parallel direction with the front (viewing) surface of the display. Moreover, the assembling devices may be formed on the upper and lower sides of the display.

Referring to Fig. 9, the liquid crystal display is mounted to the portable computer. One of the advantages of the portable computer according to the present invention over the conventional portable computer is the higher ratio of the viewing area. Because there are no fastening elements on the display surface, the outer frame of the display area of the present invention is narrower than that of conventional ones. Thus, the ratio of the viewing area can be maximized and the thickness of the display part is made thinner than that of conventional ones.

Furthermore, as the volume of the frames of the present invention is smaller than that of conventional ones, the portable computer of the present invention is lighter. Additionally, as it is not necessary to have screws, the cost for manufacturing can be reduced.

It will be apparent to those skilled in the art that various modifications and variations can be made in the computer having liquid crystal display of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is

1. A liquid crystal display device comprising:

a liquid crystal panel including a display area;

a light source ^{unit} joined with the liquid crystal panel;

5 a first ^{Support} frame coupled to a surface of the light unit and
(sides) of the liquid crystal panel;

a second ^{Support} frame coupled to edges of the liquid crystal
panel and sides of the first [support] frame;

an outer casing; and

10 a fastening part joining together the first [support]
frame, the second [support] frame, and the outer casing through the
sides of the first [support] frame, the second [support] frame, and the
outer casing.

15 2. The liquid crystal device according to claim 1, wherein
the fastening part includes a screw hole.

20 3. The liquid crystal device according to claim 1, wherein
the sides of the first [support] frame, the second [support] frame, and
the outer casing are substantially perpendicular to the viewing
[direction] ^{surface} of the display device.

4. The liquid crystal device according to claim 1, wherein the first frame supports the light source.

5. The liquid crystal device according to claim 1, wherein the second frame protects the liquid crystal panel.

6. A portable computer comprising:

a liquid crystal display device having a display surface and a first plurality of side surfaces;

a body having an input device;

a cover, coupled to an edge of the body, having a second plurality of side surfaces; and

a fastening unit attaching the first plurality of side surfaces of the liquid crystal display device to the second plurality of side surfaces of the cover, the liquid crystal display device being mounted to the cover.

7. The portable computer according to claim 6, wherein the fastening unit includes a screw hole through the first and second side surfaces of the liquid crystal display device and cover, respectively, and a screw in the screw hole.

8. The portable computer according to claim 6, wherein the fastening unit includes an adhesive joining the first plurality of side surfaces of the liquid crystal display device to the second plurality of side surfaces of the cover.

5

9. A portable computer comprising:

a liquid crystal display device having a first side surface;

a body having an input device;

a cover joined with the body and having a second side surface; and

a fastening unit joining together the liquid crystal display device and the cover through the first and second side surfaces of the liquid crystal display device and the cover, respectively.

10. A liquid crystal display device comprising:

a first support frame having a first fastening member at a side surface of the first support frame;

a reflector unit adjacent the first support frame;

a light source adjacent to the reflector unit;

a light guide unit adjacent the reflector unit;

a protection unit adjacent the light guide unit;

a prism unit adjacent the protection unit;

a diffuser unit adjacent the prism unit;

a liquid crystal panel adjacent the diffuser unit; and

5 a second support frame having a second fastening member
at a side ~~surface~~^{edge} of the second support frame, wherein the
reflector unit, the protection unit, the prism unit, and the
diffuser unit, the liquid crystal panel are between the first and
second support frame, and the first and second support ~~(frame)~~^{frames} are
10 attached to each other through the first and second fastening
members through the side ~~surfaces~~^{edges} of the first and second support
frames.

11. The liquid crystal device according to claim 10, wherein
15 the first and second fastening members include a screw hole.

12. The liquid crystal device according to claim 10, wherein
the side ~~surfaces~~^{edges} of the first and second support frames are
substantially perpendicular to the viewing ~~direction~~^{surface} of the display
20 device.

13. The liquid crystal device according to claim 10, wherein
the first ~~support~~ frame supports the light source.

14. The liquid crystal device according to claim 10, wherein
the second ~~support~~ frame protects the liquid crystal panel.

5

ABSTRACT OF THE DISCLOSURE

A liquid crystal display device includes a liquid crystal panel having a display area, a light source joined with the liquid crystal panel, a first frame coupled to a surface of the light unit and sides of the liquid crystal panel, a second frame coupled to edges of the liquid crystal panel and sides of the first support frame, an outer casing, and a fastening part joining together the first support frame, the second support frame, and the outer casing through the sides of the first support frame, the second support frame, and the outer casing.

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEYU.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

ATTORNEY DOCKET NO.: 043695-5011

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

COMPUTER HAVING LIQUID CRYSTAL DISPLAY

is attached hereto; or

was filed as United States application Serial No. 08/888,164 on JULY 3, 1997 and was amended on _____ (if applicable); or

was filed as PCT international application Number _____ on _____ and was amended under PCT Article 19 on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office information which is material to the patentability of claims presented in this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. §119:

COUNTRY (if PCT, indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. §119
KOREA	97-12899	8 APRIL 1997	[X] Yes [] No
KOREA	97-14278	17 APRIL 1997	[X] Yes [] No
			[] Yes [] No
			[] Yes [] No

Combined Declaration For Patent Application and Power of Attorney - (Continued)
(includes Reference to PCT International Applications)

ATTORNEY DOCKET NO.: 043695-5011

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to the patentability of claims presented in this application in accordance with Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. §120:

U.S. APPLICATIONS		STATUS (Check One)		
U.S. APPLICATION NO.	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.			STATUS (Check One)		
PCT APPLN. NO.	PCT FILING DATE	U.S. SERIAL NO.	PATENTED	PENDING	ABANDONED

POWER OF ATTORNEY: as a named inventor, I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Morgan, Lewis & Bockius LLP

Robert J. Gaybrick, Reg. No. 27,890; Richard S. Meyer, Reg. No. 32,541; C. Scott Talbot, Reg. No. 34,262; Reid G. Adler, Reg. No. 30,988; J. Michael Thesz, Reg. No. 40,354; John G. Smith, Reg. No. 33,818; Song K. Jung, Reg. No. 35,210; Michele M. Schafer, Reg. No. 34,717; Matthew T. Bailey, Reg. No. 33,829; Jeffrey A. Lindeman, Reg. No. 34,658; John D. Zele, Reg. No. 39,887; Mary Jane Boswell, Reg. No. 33,652; Michele V. Frank, Reg. No. 37,028, Michael P. Tierney, Reg. No. 35,388.

Send Correspondence To:

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1800 M Street, N.W.
Washington, D.C. 20036-5869

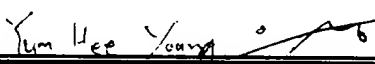


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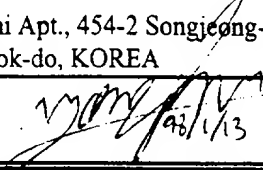

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Listing of Inventors Continued on attached page(s) ☒ Yes ☐ No

Combined Declaration For Patent Application and Power of Attorney - (Continued)
(includes Reference to PCT International Applications)

ATTORNEY DOCKET NO.: 043695-5011

FULL NAME OF FOURTH INVENTOR	Yong Bum KIM	
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FIFTH INVENTOR'S SIGNATURE 		DATE 12.1.13
FULL NAME OF SIXTH INVENTOR		
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POST OFFICE ADDRESS		
SIXTH INVENTOR'S SIGNATURE		DATE
		DATE

Listing of Inventors Continued on attached page(s) ☐ Yes ☒ No

FIG. 1
PRIOR ART

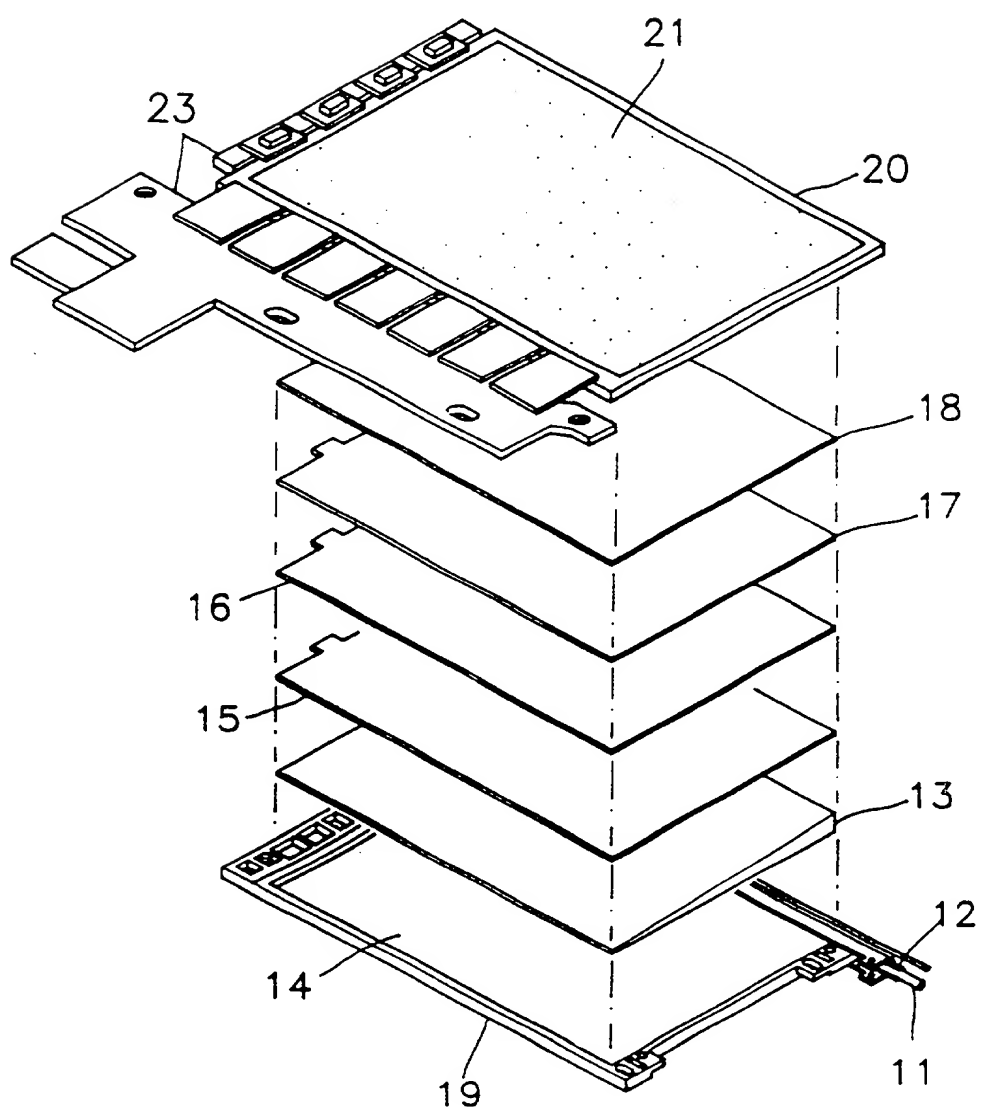


FIG. 2
PRIOR ART

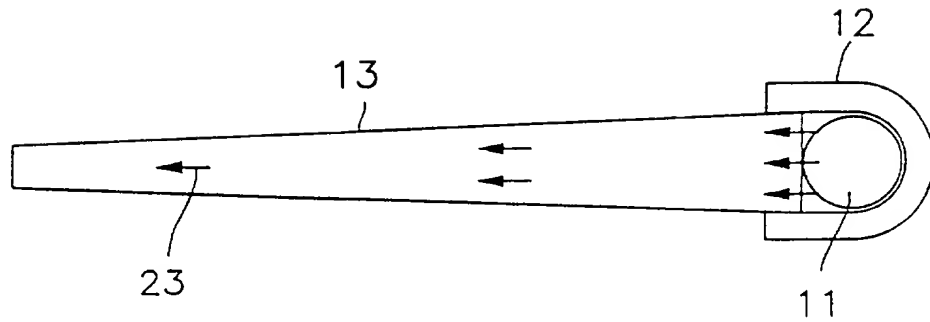


FIG. 3a
PRIOR ART

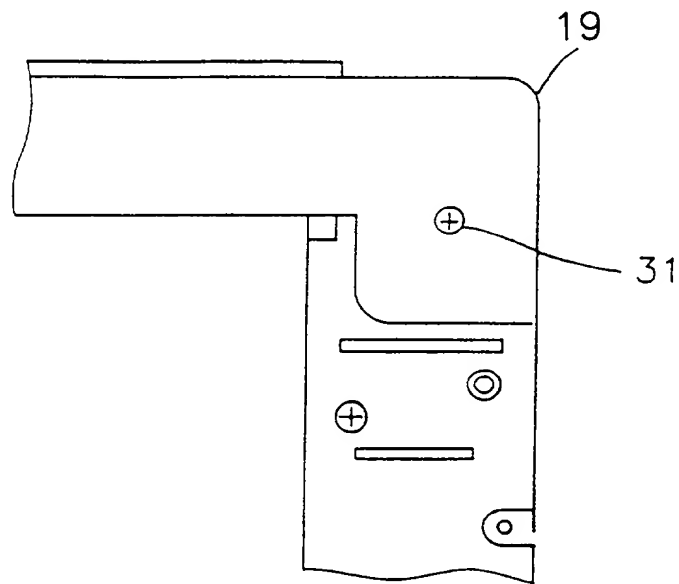


FIG. 3b
PRIOR ART

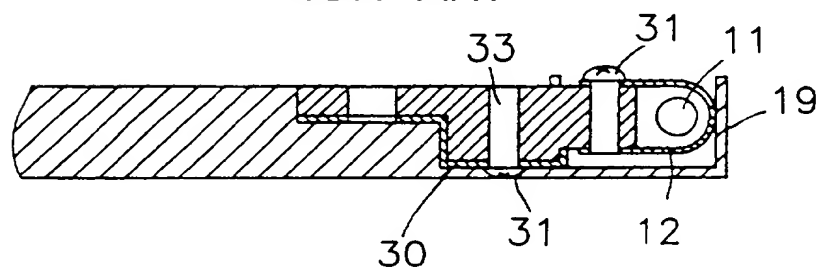


FIG. 4
PRIOR ART

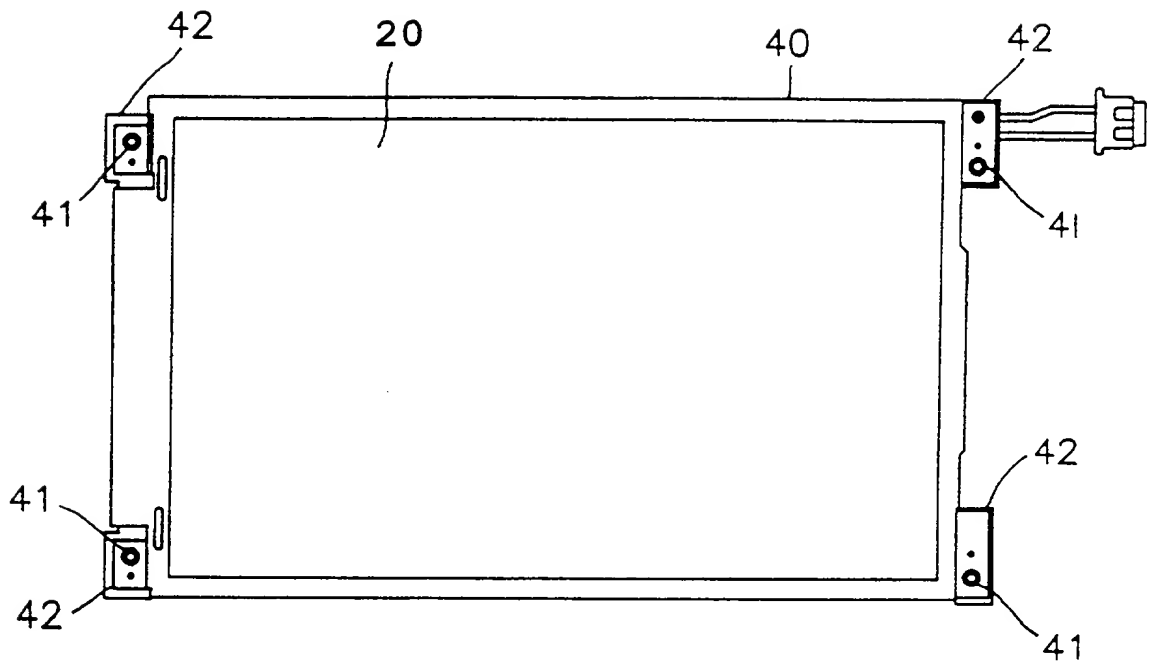


FIG. 5
PRIOR ART

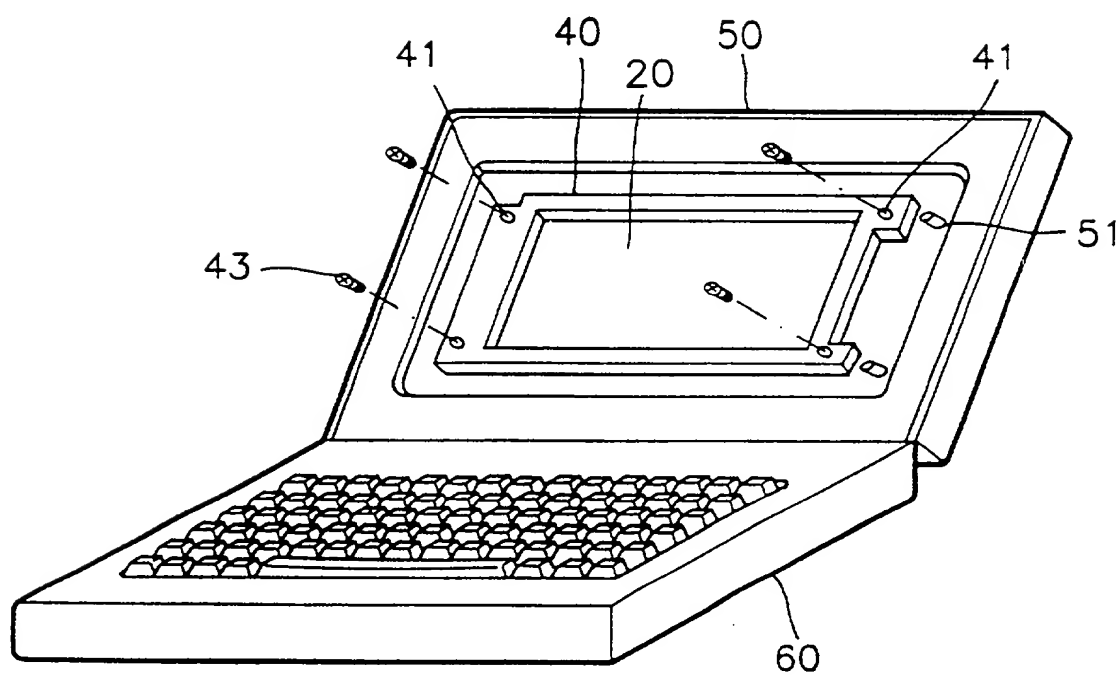


FIG. 6

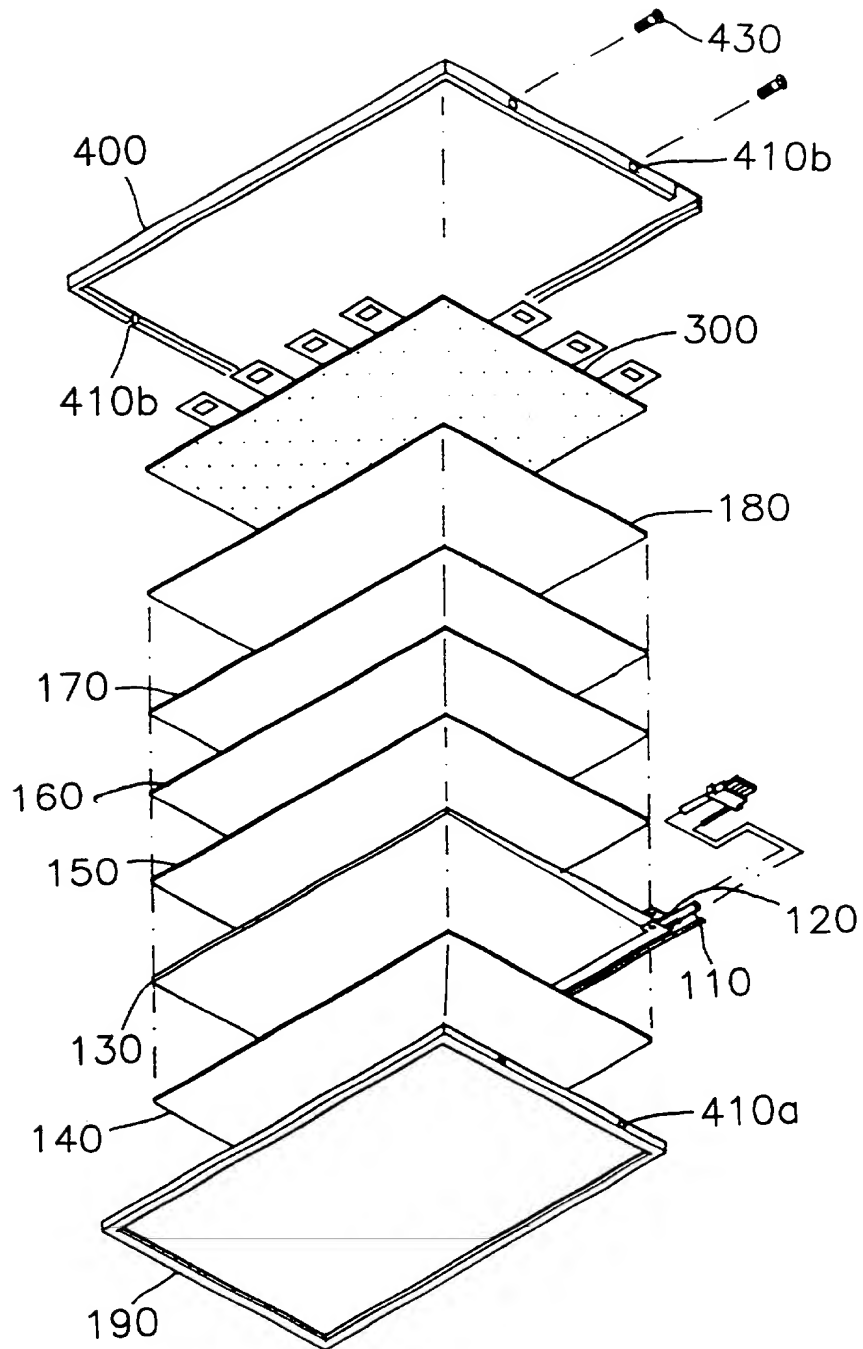


FIG. 7

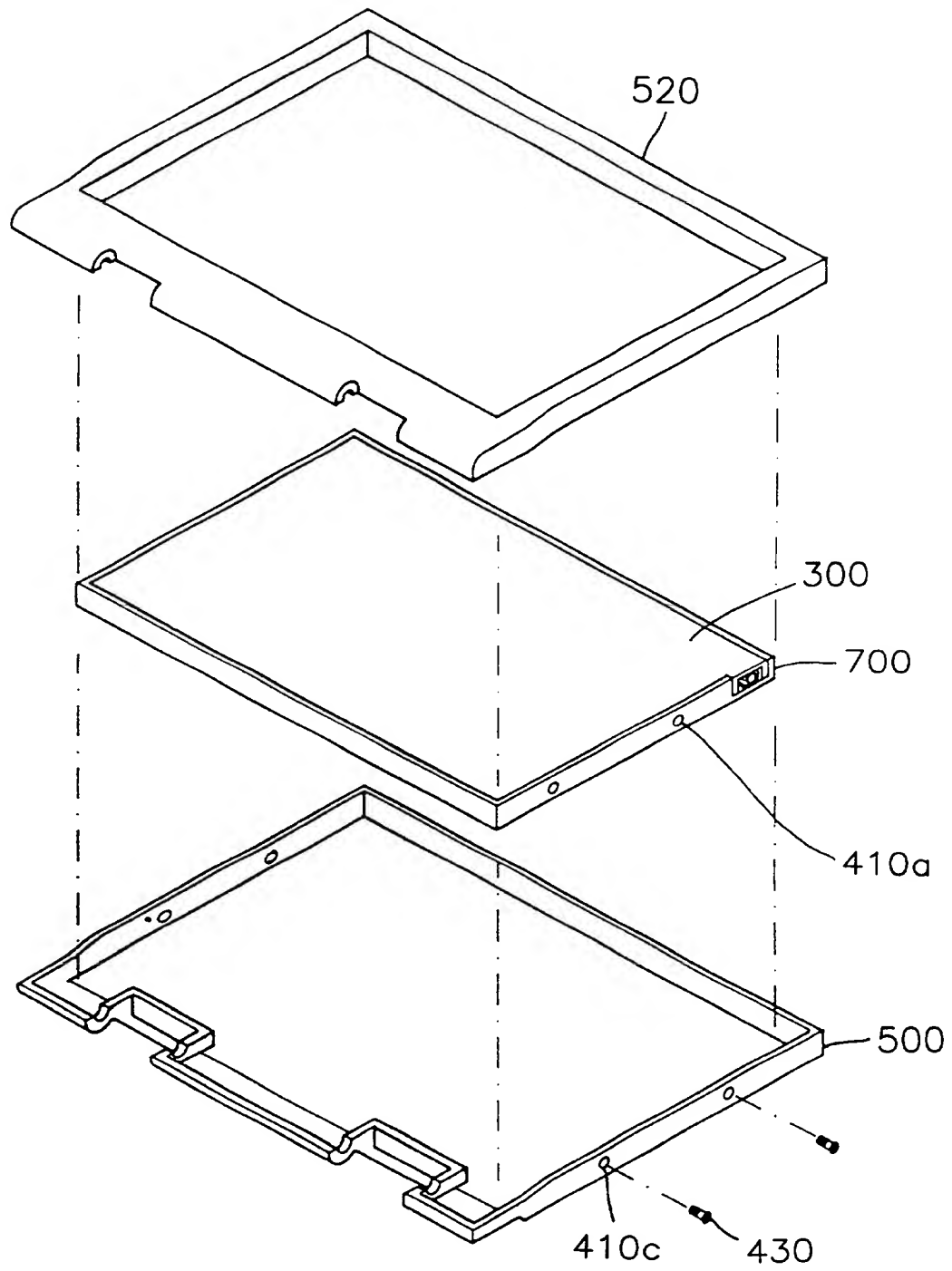


FIG. 8

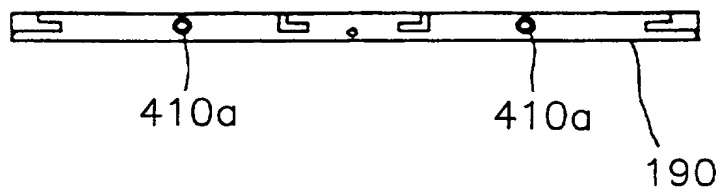


FIG. 9

